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Translocation and new geographical distribution of the invasive Redbelly Tilapia, *Coptodon zillii* (Gervais, 1848) (Teleostei: Cichlidae) in southern Iran

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Abstract: A new geographical distribution record of the invasive species of Redbelly Tilapia, *Coptodon zillii*, is reported here from a drainage in southern Iran, based on the discovery of a population at Howba spring. The locality of the new record is now completely dominated by this exotic fish; this location was previously inhabited by native fishes. As tilapia species have a high resilience to harsh environmental conditions, they can easily be translocated to, and establish in, new habitats. Thus, ecological monitoring of this exotic fish species is highly recommended.

Key words: range extension; Howba spring; Mond basin; exotic species

Introduction of fish species into the Iranian freshwater ecosystems has been well documented, with the introduction of *Gambusia holbrooki* Girard, 1859 (Poeciliidae) in the 1920s and *Cyprinus carpio* Linnaeus, 1758 (Cyprinidae) in the late 1930s (Coad & Abdoli 1993; Coad 1996). Since then, more than 33 fish species have been introduced or translocated and some of them have become well established in several water bodies in Iran (Coad 1996; Esmaeili et al. 2007, 2014; Khaefi et al. 2014).

Based on recent studies, the number of exotic species is increasing drastically, and the Redbelly Tilapia, *Coptodon zillii* (Gervais, 1848), is one of these recently introduced fish (Khaefi et al. 2014; Roozbhfar et al. 2014). *Coptodon zillii* is a cichlid fish native to Africa, which has been widely introduced worldwide in America, Europe, Australia, and Asia; it is currently found in more than 56 countries either as native or introduced fish (http://www.fishbase.org).

Coptodon zillii has been reported from Egypt, Jordan, and Lebanon as a native fish, and from Saudi Arabia, Syria, Iraq, and recently Iran as an introduced species (Job 1967; Coad 2012; Khaefi et al. 2014; Roozbhfar et al. 2014). Translocation of this species has increased remarkably, and its range is expanding continuously. The geographical distribution of this species in Iran includes the Shadegan wetland and the Dez River, both from Tigris–Karoun basin in southwest Iran. We report here a translocation and new geographical record for this species in southern Iran. The new record is located in the Mond River drainage in southern Iran, 600 and 730 km from previous recorded locations for this species (Khaefi et al. 2014; Roozbhfar et al. 2014).

In total, seven specimens of *Coptodon zillii* were collected by net of length 3 m and mesh size of 10 mm during fieldwork. The specimens captured were euthanized using an overdose of MS-222 (300–400 mg/L) for 15 min. The specimens were preserved in a 10% formalin solution for a day and transported to the laboratory. In the laboratory, they were washed with water and finally stored in 70% alcohol. The locality of the new record is at the Howba spring, Juyom-Bidshehr Road, Fars Province, Iran, 27°58′20.14″ N, 053°52′22.83″ E, 640 m above sea level (Figure 1). Specimens were collected on 19 March 2016 by AT, MM, Mohammad Motamedi and Negar Mirzania. The Howba spring is a hot sulphuric spring located adjacent to the Hirm wetland. The specimens were deposited in the Zoological Museum of Shahid Bahonar University of Kerman (ZM-SBUK), Iran under the voucher numbers ZM-SBUK 3500 to 3506.

Specimens were identified based on morphological and meristic characters following Teugels et al. (2003). The collected specimens of *Coptodon zillii* were identified by having dorsal fin with 14–16 spines and 10–14 soft rays; anal fin with 8–10 soft rays; 8–11 lower gill rakers; 28–33 scales on lateral line and with dark longitudinal stripes on flanks (Figure 2). *Coptodon zillii* differs from *C. deckerti*, *C. nigrans*, and *C. fusiforme* by having 10–14 dorsal soft fin rays (vs. 11–12 in *C. deckerti*, 10–14 in *C. nigrans*, and 11–12 in *C. fusiforme*), and from *C. deckerti* by having 28–33 scales on lateral line (vs. 25–27 scales).

Additional exotic species were also identified in the Howba spring and the wetland: *Gambusia holbrooki* Girard, 1859; *Sander lucioperca* (Linnaeus, 1758); *Carassius*

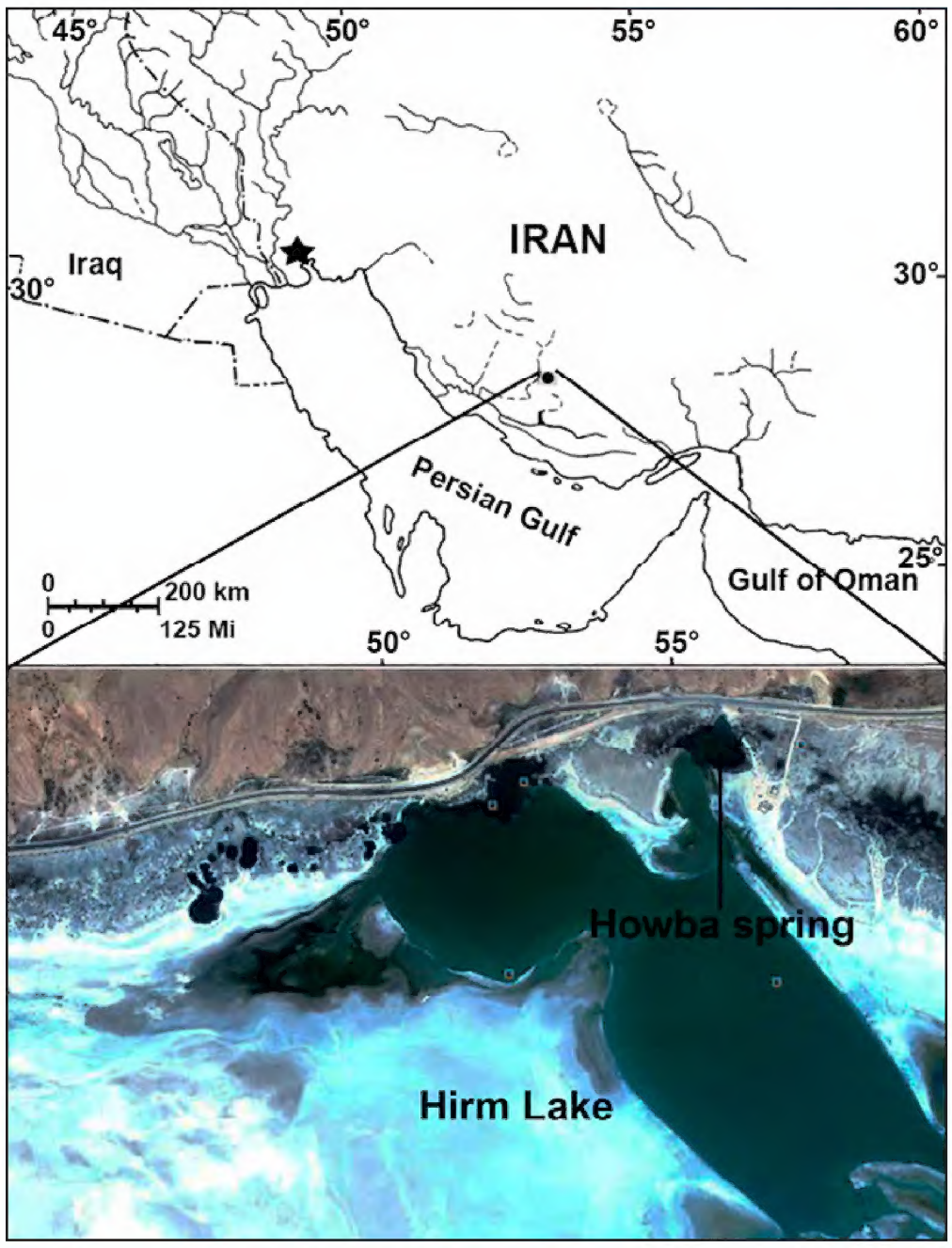

Figure 1. Translocation and new geographical distribution record for *Coptodon zillii* in Howba microhabitat, in southern Iran. Star symbol indicates the previously known distribution of the species in southwestern Iran, and the black circle shows the new geographic location in southern Iran.

auratus (Linnaeus, 1758); and *Cyprinus carpio* Linnaeus, 1758. It seems that *C. zillii* was accidentally introduced to the new location from its previous habitats along with commercially valuable fishes.

During four fieldworks in the last eight years in Howba spring, the abundance of the cyprinodont *Aphanius dispar,* the only native species in the spring, was significant in the first two samplings. The other species captured was the exotic *Gambusia holbrooki*. However, during our recent fieldwork, no individuals of *Aphanius dispar* were observed or captured in this locality and *Coptodon zillii* and *Gambusia holbrooki* were abundantly recorded. Since tilapias compete aggressively with native fishes, it is clear that the ichthyofauna of this microhabitat has changed recently, and the native fish ousted by the aggressive exotic species. The introduction and translocation of exotic species are owing to aquaculture, the control of malaria and accidental introduction. According to Khaefi et al. (2014), *Coptodon zillii* has been recorded in the Shadegan wetland of southwestern Iran in 2012. However, based on the statements of local fishermen soon after 2012, it was available in daily catches (Khaefi et al. 2014). This species was translocated a significant distance from its previous geographical distribution records.

Tilapia can tolerate large fluctuations in temperature, dissolved oxygen, and salinity (Martin et al. 2010). This adaptation, along with their rapid growth rates, high fecundity, and omnivorous feeding habits, allow them to breed and to establish themselves readily in areas outside their native range (Martin et al. 2010). These factors may further contribute to the successful breeding and establishment of this exotic cichlid in other Iranian inland ecosystems in very near future. Therefore, ecological monitoring is highly recommended.

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Figure 2. Live specimen of *Coptodon zillii,* 187 mm SL, collected from Howba spring. Photo by AT.

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